

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Geranium hillebrandii*

COMMON NAME: Nohoanu

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: March 2007

STATUS/ACTION

☐ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? Yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, since publication of the last CNOR, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs) because most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations, and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken, see the discussion of "Progress on Revising the Lists" in the current CNOR, which can be viewed on our Internet website (<http://www.fws.gov/endangered>).

☐ Listing priority change

Former LP: ☐

New LP: ____

Date when the species first became a Candidate (as currently defined): October 25, 1999

____ Candidate removal: Former LP: ____

____ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

____ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

____ F – Range is no longer a U.S. territory.

____ I – Insufficient information exists on biological vulnerability and threats to support listing.

____ M – Taxon mistakenly included in past notice of review.

____ N – Taxon does not meet the Act's definition of "species."

____ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Geraniaceae (Geranium family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

LAND OWNERSHIP: *Geranium hillebrandii* occurs primarily on State (West Maui Natural Area Reserve and Forest Reserve) and private (Puu Kukui Preserve) land, with about 30 percent of the individuals on County land in a watershed management area.

LEAD REGION CONTACT: Scott McCarthy, (503) 231-6131, scott_mccarthy@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, (808) 792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION

Species Description

Geranium hillebrandii is a decumbent subshrub with stems that are dark reddish brown to nearly black, growing embedded in moss mats or other bog plants, often rooting at the nodes, and 1.6 to 3.3 feet (5 to 10 decimeters) long. Leaves are alternate, elliptic to elliptic-cuneate, 0.6 to 1.0 inches (in) (1.5 to 2.6 centimeters (cm)) long, 0.4 to 0.6 in (0.9 to 1.5 cm), wide, with the upper surface pubescent on veins, the lower surface densely grayish silky strigose, and the margins entire except the apex, which is 5- to 7-toothed. Flowers usually are three to four in terminal cymes that project beyond the leaves. The petals are white with purple veins and 0.4 to 0.6 in (10 to 15 millimeters (mm)) long. Carpel bodies are 0.12 in (3 mm) long and densely pubescent. Seeds are one per cell, dark reddish brown, oblong-obovoid, 0.1 in (2.5 mm) long, and have a

reticulate surface (Wagner *et al.* 1999a).

Taxonomy

Geranium hillebrandii was first described as *Geranium humile* by Hillebrand (1888). In 1997 there was a nomenclatural change for *G. humile* to *G. hillebrandii* by Aedo and Garmendia (1997). *Geranium hillebrandii* is recognized as a distinct taxon in the supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003), the most recently accepted treatment of Hawaiian plants.

Habitat/Life History

Geranium hillebrandii is found in *Metrosideros* (ohia) mixed montane bogs, and mixed sedge and grass bogs, with the associated native species: *Plantago pachyphylla* (laukahi kuahiwi), *Oreobolus furcatus* (no common name (NCN)), *Leptecophylla tameiameiae* (pukiawe), *Viola maviensis* (NCN), *Rhynchospora chinensis* spp. *spiciformis* (kuolohia), *Carex montis-eeka* (NCN), *Machaerina* spp. (uki), *Keysseria maviensis* (howaiaulu), *Argyroxiphium caliginis* (Eke silversword), *Dubautia laxa* (naenae pua melemele), *Lycopodiella cernua* (wawaeiole), and *Sanicula purpurea* (snakeroot), at elevations between 4,350 and 5,780 feet (ft) (1,326 and 1,762 meters (m)) (Hawaii Biodiversity and Mapping Program (HBMP) 2006a). A population occurs in anomalous habitat in *Metrosideros-Dicranopteris* (ohia-uluhe) montane mesic shrubland with the associated native species *Leptecophylla tameiameiae*, *Machaerina* spp., and *Vaccinium* spp. (ohelo), at elevations between 3,800 and 4,180 ft (1,158 and 1,274 m) (H. Oppenheimer, Plant Extinction Prevention Program, pers. comm. 2006; HBMP 2006a).

Historical Range

Little is known of the historical locations of *Geranium hillebrandii*. The type collection was made in the 1800s at Eke, the summit of the west Maui mountains (Hillebrand 1888).

Current Range/Distribution

Currently, *Geranium hillebrandii* is found in bogs in the west Maui mountains in Puu Kukui Preserve, extending east to Eke and as far south as the Lihau section of the West Maui Forest Reserve and the Olowalu rim on west Maui (HBMP 2006a).

Population Estimates/Status

Previously known from two populations totaling approximately 1,000 to 2,000 individuals in 1999, *Geranium hillebrandii* is currently known from three populations totaling approximately 10,000 individuals (K. Wood, National Tropical Botanical Garden, pers. comm. 1996; Wood 2005; H. Oppenheimer, pers. comms. 1999, 2005, and 2006). The increase in numbers of individuals is reflective of more thorough surveys (Wood 2005). The populations are located at Puu Kukui (including East Bog, Kahoolewa ridge, and Kanaha-Kahoma ridge), Eke and south Eke, and in the Lihau section of the West Maui Forest Reserve (including Olowalu rim), all in the west Maui mountains (HBMP 2006a).

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

This species is likely threatened by feral pigs (*Sus scrofa*) that degrade and destroy habitat (K. Wood, pers. comm. 1996; H. Oppenheimer, pers. comm. 1999). Pigs were observed to be a threat to the Eke population as early as 1989 (HBMP 2006a). Management of Puu Kukui Preserve as a watershed area has helped to reduce the number of feral pigs in that area; however, feral pigs are present at lower elevations and remain a threat to the native plants and ecosystem of the west Maui mountains (Maui Land and Pineapple Company 2002).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Cook in 1778, with many other introductions thereafter (Tomich 1986). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, formed herds, and are now managed as a game animal by the State to optimize hunting opportunities (Tomich 1986; State of Hawaii 2001). A study was conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui (Diong 1982). This valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* (koa) to *Metrosideros polymorpha* (ohia). Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 in (20 cm), greatly disrupting the leaf litter and topsoil layers, contributing to erosion and changes in ground topography. The feeding habits of pigs created seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982). The effects on mesic and wet forest habitat by foraging of feral pigs have also been reported in fencing studies. In a fencing study conducted in the montane bogs of Haleakala, it was found that when feral pigs were fenced out of an area the cover of native plant species increased from 6 percent to 95 percent within six years of protection (Loope *et al.* 1991).

Hawaiian ecosystems, having evolved without disturbance of hoofed mammals, are susceptible to large-scale disturbance by pigs and other introduced ungulates (Loope *et al.* 1991). Because of demonstrated habitat modifications by feral pigs such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants; the U.S. Fish and Wildlife Service (Service) believes they are a threat to this species.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

None known.

C. Disease or predation.

Predation by feral pigs is a likely threat to *Geranium hillebrandii*, primarily at the Eke and Lihau-Olowala populations (HBMP 2006a). In a study conducted in the 1980s, feral pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982). A stomach content analysis in this study showed that the pigs' food sources consisted of native plants, 60 percent of which were *Cibotium* spp., (tree ferns) alternating with *Psidium cattleianum* (strawberry guava) when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species, with larger trees killed over a few months of repeated feeding.

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost or never developed natural defenses for such impacts (Carlquist 1980, Lamoureux 1994). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al.* 1991). Therefore, even though there are no observations of browsing for *Geranium hillebrandii*, it is likely that pigs impact this species directly as well as the surrounding habitat.

D. The inadequacy of existing regulatory mechanisms.

Geranium hillebrandii currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pigs are managed in Hawaii as a game animal, but may populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii, Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c, n.d.-d.), however, public hunting is not adequate to eliminate this threat to *Geranium hillebrandii*.

E. Other natural or manmade factors affecting its continued existence.

Alien plant species are a major threat to *Geranium hillebrandii* as they degrade habitat, and outcompete native plants (K. Wood, pers. comm. 1996; M. Bruegmann and J. Burgett, Service, pers. comm. 1996). The nonnative plant species reported to be the greatest threat to *G. hillebrandii* in Puu Kukui Preserve and at Eke is *Tibouchina herbacea* (glorybush) (K. Wood, pers. comm. 1996). Other nonnative plant species that threaten *G. hillebrandii* include two rush species, *Juncus planifolius* (bog rush), and *J. effusus* (Japanese mat rush), and *Rubus argutus* (prickly Florida blackberry) (M. Bruegmann and J. Burgett, pers. comm. 1996; K. Wood, pers. comm. 1996).

Tibouchina herbacea, a member of the Melastomataceae family, is native to southern Brazil, Uruguay, and Paraguay. In Hawaii, it is naturalized and abundant in disturbed mesic to wet forest on the islands of Hawaii, Maui, and Lanai (Wagner *et al.* 1999a). It forms dense thickets, crowding out all other plant species and inhibiting regeneration of native plants (The Nature Conservancy 2003). All members of this genus are legally declared noxious in the state of Hawaii (HAR Title 4, Subtitle 6, Chapter 68). Research is ongoing for biological controls of this species (Smith 1998; The Nature Conservancy 2003).

Juncus planifolius is a perennial herb which has naturalized in moist, open, disturbed depressions on margins of forests and in bogs on Kauai, Oahu, Molokai, Maui, and Hawaii (Coffey 1999). This species forms dense mats and has the potential of displacing natives by preventing establishment of native seedlings (Medeiros *et al.* 1991).

Juncus effusus is a perennial herb widely distributed in temperate regions and naturalized in Hawaii in ponds, streams, and open boggy sites. It was brought to Hawaii as a source of matting material, but grew too slowly to be of commercial value (Coffey 1999). This plant spreads by

seeds and rhizomes, and forms dense mats that crowd out native plants (Pojar and Mackinnon 1994).

Rubus argutus is native to the central and eastern United States, and is a serious weed that naturalizes in a variety of disturbed habitats (Tunison 1991). It reproduces both vegetatively and by seed (Tunison 1991). *Rubus argutus* was introduced to Hawaii in the late 1800s and was quickly spread by birds (Wagner *et al.* 1999a; Tunison 1991). This taxon grows via runners underground, and readily resprouts from them if above ground tissue is treated with herbicide (U.S. Army 2006). Biological controls were introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al.* 1999a). Confirmed personal observations (Wood 2005) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al.* 1998) indicate nonnative plant species may outcompete native plants similar to *Geranium hillebrandii*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997, Loope *et al.* 2004). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al.* 1997). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the bog habitat of *G. hillebrandii*, the Service believes nonnative plant species are a threat to this species.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The State of Hawaii and private landowners have initiated ungulate control and/or weed control in areas where this species occurs. Construction of an ungulate exclosure fence in the Kahakuloa Game Management Area (GMA) on Maui, funded through a Service grant to the State Division of Forestry and Wildlife, provides indirect protection of individuals of *Geranium hillebrandii* by preventing ingress of feral ungulates into the summit area from the Kahakuloa GMA (Maui Pineapple Company 1999). The West Maui Mountain Watershed Partnership, a non-governmental, non-profit partnership composed of west Maui landowners and managers, received funding from the Service for ungulate exclosure fences for the Puu Kukui Preserve, which have been completed, and for ungulate and nonnative plant control, which are ongoing (Maui Land and Pineapple Company 2002; Service 2005 and 2006). These actions provide some protection for two of the three populations of *G. hillebrandii*. In addition, our Partners for Fish and Wildlife Program is prioritizing our restoration efforts for this species as part of the FY 2007 President's Budget Candidate Conservation Pilot Project. We will strive to implement Partners Program habitat improvement projects to remove and/or ameliorate threats to this species such that we will have a high likelihood of being able to remove this species' candidate status by the

year 2010.

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral pigs and nonnative plants, we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Geranium hillebrandii*, due to competition with nonnative plants for space, nutrients, water, air, and light. Predation by feral pigs is a likely threat to *G. hillebrandii*. Conservation measures taken for control of feral pigs and nonnative plants reduce the impact of these threats to *G. hillebrandii*; however, continued monitoring will be necessary to keep the areas threat-free. The population of *G. hillebrandii* at the Lihau section of the West Maui Forest Reserve (including Olowalu rim) is still impacted by these threats. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Continue control of feral pigs
- Continue control of alien plants
- Begin propagation efforts for maintenance of genetic stock

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8*
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

This species is moderately threatened by pigs that degrade and destroy habitat, and by nonnative plants that outcompete and displace it. Threats to the bog habitat of *Geranium hillebrandii*, and

to individuals of this species, are expected to continue or increase without their control or eradication. Monitoring and removal of feral pigs is ongoing at the Puu Kukui Preserve, but the fences must be continually maintained to prevent incursion. Monitoring and reduction of nonnative plant numbers is ongoing in the Puu Kukui Preserve. The population in the Lihau section of the west Maui Forest Reserve (including Olowalu rim) is still impacted by these threats.

Imminence:

Threats to *Geranium hillebrandii* from feral pigs and nonnative plants are imminent because they are ongoing in the Lihau section of the West Maui Forest Reserve (including Olowalu rim) population.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, individuals of *Geranium hillebrandii* benefit from conservation actions by the State Division of Forestry and Wildlife, private landowners, and the West Maui Mountain Watershed Partnership, funded in part by the Service. These conservation actions include construction of ungulate exclosures in the Kahakuloa GMA, and fencing and nonnative plant control in the west Maui mountains (Maui Pineapple Company 1999; Maui Land and Pineapple Company 2002). If it becomes apparent that the routine listing process is not sufficient to prevent further losses that may result in this subspecies' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *G. hillebrandii* new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING

The information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December 1995, and was updated by personal communication with Ken Wood of the National Tropical Botanical Garden in 1996; Marie Bruegmann and Jeff Burgett of the Service in 1996; and Hank Oppenheimer, Maui Pineapple Company, in 1999. We incorporated additional new information on this species from information in our files and from the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Arthur Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new information on range or status was provided. In 2005 we contacted species experts, and received new information on this taxon from Hank Oppenheimer. In 2006, the Pacific Islands Office contacted the species experts listed below. New information on status and range was received from Hank Oppenheimer and was incorporated into this assessment.

List all experts contacted:

Name	Date	Affiliation
Abbott, Lyman	08/11/06	Kahoolawe Island Reserve Commission
Agorastos, Nick	08/11/06	Hawaii Division of Forestry and Wildlife
Aruch, Sam	08/11/06	The Nature Conservancy
Bakutis, Ane	08/11/06	Plant Extinction Prevention Program
Bartlett, Randy	08/15/06	Maui Land and Pineapple Company
Belfield, Thomas	08/15/06	National Park Service
Bender, David	08/11/06	National Tropical Botanical Garden
Burney, David	08/11/06	National Tropical Botanical Garden
Caraway, Vickie	09/13/06	Hawaii Division of Forestry and Wildlife
Cassel, Katie	08/11/06	Kokee Resource Conservation Program
Chimera, Chuck	08/11/06	National Park Service
Clark, Michelle	08/11/06	Natural Resources Conservation Service
Cordell, Susan	08/11/06	U.S. Forestry Service
Denslow, Julie	08/11/06	U.S. Forestry Service
Drake, Don	08/11/06	University of Hawaii
Duvall, Fern	08/11/06	Hawaii Division of Forestry and Wildlife
Gagne, Betsy	08/11/06	Hawaii Division of Forestry and Wildlife
Garnett, Bill	08/11/06	National Park Service, Kalaupapa
Giffin, Jon	08/11/06	The Nature Conservancy
Gon, Sam	08/11/06	The Nature Conservancy
Hadway, Lisa	08/11/06	Hawaii Division of Forestry and Wildlife
Higashino, Paul	08/11/06	Kahoolawe Island Reserve Commission
Hobdy, Robert	08/11/06	Retired, HI Division of Forestry & Wildlife
Hoffman, Nancy	09/12/06	U.S. Fish and Wildlife Service, Refuges
Hughes, Guy	08/11/06	National Park Service
Imada, Clyde	08/11/06	Bishop Museum
Jacobi, Jim	08/11/06	U.S. Geological Survey
Jeffrey, Jack	08/11/06	U.S. Fish and Wildlife Service, Refuges
Kaufman, J. Boone	08/11/06	U.S. Forestry Service
Kawakami, Galen	08/08/06	Hawaii Division of Forestry and Wildlife
Kawelo, Kapua	08/11/06	U.S. Army, Environmental Division
Kiyabu, Brian	08/11/06	Amy Greenwell Botanical Garden
Koob, Gregory	08/11/06	Natural Resources Conservation Service
Lau, Joel	08/11/06	Hawaii Biodiversity and Mapping Program
Liesemeyer, Brent	08/11/06	Hawaii Division of Forestry and Wildlife
Loh, Rhonda	08/11/06	National Park Service
Loope, Lloyd	08/11/06	U.S. Geological Survey
Medeiros, Arthur	08/11/06	U.S. Geological Survey
Menard, Trae	08/11/06	The Nature Conservancy
Misaki, Ed	08/11/06	The Nature Conservancy
Morden, Cliff	08/11/06	University of Hawaii

Moses, Wailana	08/11/06	The Nature Conservancy
Naboa, Eldridge	08/11/06	The Nature Conservancy
Nakai, Glynnis	08/11/06	U.S. Fish and Wildlife Service
Oppenheimer, Hank	08/11/06	Plant Extinction Prevention Program
Palmer, Dan	08/11/06	amateur pteridologist
Pelizza, Sylvia	08/11/06	U.S. Fish and Wildlife Service, Refuges
Perlman, Steve	08/11/06	National Tropical Botanical Garden
Perry, Lyman	08/11/06	Hawaii Division of Forestry and Wildlife
Pratt, Linda	08/11/06	U.S. Geological Survey
Rehkemper, Cindy	06/06/06	U.S. Fish and Wildlife Service, Refuges
Rivers, Julie	09/12/06	U.S. Navy, Environmental Division
Ryder, Micah	08/11/06	Koolau Mountains Watershed Partnership
Sailer, Dan	08/11/06	The Nature Conservancy
Scowcroft, Paul	08/11/06	U.S. Forestry Service
Seidman, Stephanie	07/25/06	Maui Nui Botanical Gardens
Starr, Forest	08/11/06	U.S. Geological Survey
Sugii, Nellie	08/30/06	Lyon Arboretum
Tangalin, Natalia	05/24/06	National Tropical Botanical Garden
Warshauer, Rick	08/11/06	U.S. Geological Survey
Wass, Richard	08/11/06	U.S. Fish and Wildlife Service, Refuges
Welton, Patti	12/13/06	National Park Service
Whitehead, Namaka	08/11/06	Kamehameha Schools
Wood, Ken	08/11/06	National Tropical Botanical Garden
Yoshiokia, Joan	08/11/06	National Park Service

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006b). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be considered at risk) by Wagner *et al.* (1999b). *Geranium hillebrandii* is not included in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al.* 2005).

COORDINATION WITH STATES

In September 2006 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, Division of Forestry and Wildlife, pers. comm. 2006).

LITERATURE CITED

- Aedo, C. and F. Munoz Garmendia. 1997. Twelve new names in *Geranium* L. (Geraniaceae). Kew Bulletin 52: 725-727.
- Carlquist, S. 1980. Hawaii: a natural history, second edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.

- Coffey, J.C. 1999. Juncaceae: in Wagner, W.L., D.R. Herbst, and S.H. Sohmer (eds.), Manual of the Flowering Plants of Hawaii, University of Hawaii Press and Bishop Museum Press, Honolulu, Bishop Museum Special Publication 97. Pp. 1,451-1,455.
- Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. 138 pp.
- Diong, C.H. 1982. Population biology and management of the feral pig (*Sus scrofa* L.) in Kipahulu Valley, Maui. Dissertation to the Zoology graduate division of the University of Hawaii. 408 pp.
- Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guava* (common guava), forest weeds in Hawaii. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Technical Report 95. 105 pp.
- Hawaii Biodiversity and Mapping Program. 2006a. Program database. Unpublished.
- Hawaii Biodiversity and Mapping Program. 2006b. *Geranium hillebrandii*. <http://hbmp.hawaii.edu/printpage.asp?spp=PDGER020G0>, downloaded on March 29, 2007.
- Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-d. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Kauai. Division of Forestry and Wildlife, Honolulu. 6 pp.
- Hawaii Heritage Program. 1990. Management recommendations for Na Pali coast state park, island of Kauai. The Nature Conservancy, prepared for the Hawaii Department of Land and Natural Resources, Division of State Parks, Honolulu. 18 pp.
- Hillebrand, W. 1888. Flora of the Hawaiian islands: a description of their phanerogams and vascular cryptogams. C. Winter, Heidelberg; Williams and Norgate, London; and B.

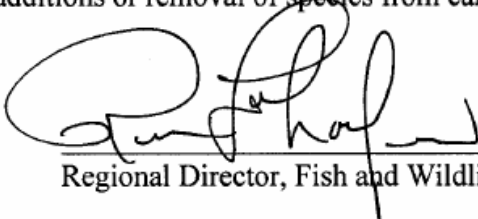
- Westermann and Company, New York. 673 pp.
- Lamoureux, C.H. 1994. Conserving Hawaiian biodiversity – the role of Hawaiian botanical gardens. *in* Peng, C.-I and C.H. Chou (eds.), Biodiversity and Terrestrial Ecosystems, Institute of Botany, Academia Sinica Monograph Series No. 14. Pp. 55-57.
- Loope, L., A.C. Medeiros, and B.H. Gagne. 1991. Recovery of vegetation of a montane bog following protection from feral pig rooting. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Technical Report 77. 23 pp.
- Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
- Loope, L., F. Starr, and K. Starr. 2004. Protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.
- Maui Land and Pineapple Company. 2002. Natural area partnership program, Puu Kukui watershed management area, annual report for fiscal year 2002. July 2001-June 2002. 25 pp. + appendices.
- Maui Pineapple Company, Ltd. 1999. Puu Kukui watershed management area, Kahalawai, Maui, Hawaii, fiscal year 1999 progress report, biannual report. Submitted to the State of Hawaii Department of Land and Natural Resources Natural Area Partnership Program, January, 1999.
- Medeiros, A.C., L.L. Loope, P. Conant, S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Records of the Hawaii Biological Survey for 1996, Bishop Museum Occasional Papers 48: 23-36.
- Medeiros, A.C., L.L. Loope, and B.H. Gagne. 1991. Degradation of vegetation in two montane bogs of Haleakala National Park: 1982-1988. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Technical Report 78. 31 pp.
- Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.
- Medeiros, A.C., L.L. Loope, P. Conant, S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian islands. Records of the Hawaii Biological Survey for 1996, Bishop Museum Occasional Papers 48: 23-36.
- Meyer, J.-Y. and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvescens* D.C. (Melastomataceae). Journal of Biogeography 23: 775-781.

- Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung. 2005. Hawaii's Comprehensive Wildlife Conservation Strategy. Department of Land and Natural Resources, Honolulu, Hawaii. 722 pp.
- Nagata, R.F. and G.P. Markin. 1986. Status of insects introduced in Hawaii for the biological control of the wild blackberry *Rubus argutus*: in Proceedings of the Sixth Conference in Natural Sciences, Hawaii Volcanoes National Park, Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 53-64.
- Pojar, J. and A. MacKinnon (eds.). 1994. Plants of the Pacific northwest coast. Vancouver, BC: Lone Pine Publishing. 528 pp.
- Robichaux, R., J. Canfield, F. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. "Radiating" plants-adaptive radiation. Endangered Species Bulletin November/December. 3 pp.
- Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawaii. Proceedings of the Second Conference on Natural Science, Hawaii Volcanoes National Park. Pp. 274-288.
- Smith, C.W. 1985. Impact of alien plants on Hawaii's native biota: in Stone, C.P., and J.M. Scott (eds.), Hawaii's Terrestrial Ecosystems: Preservation and Management, Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 180-250.
- Smith, C.W. 1998. Impact of alien plants on Hawaii's native biota. Cooperative National Park Studies Unit.
http://www.botany.hawaii.edu/faculty/cw_smith/aliens.htm#Plant%20Pests%20of%20Hawaiian%20Native
- State of Hawaii. 2001. Game mammal hunting guide.
<http://www.state.hi.us/dlnr/dcre/mammalguide.html>, downloaded February 13, 2007.
- The Nature Conservancy. 2003. Kapunakea Preserve, west Maui, Hawaii: long-range management plan fiscal years 2004-2009. 29 pp.
- Tomich, P.Q. 1986. Mammals in Hawaii; a synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.
- Tunison, T. 1991. The Nature Conservancy element stewardship abstract for *Rubus argutus*. The Nature Conservancy, Arlington. 7 pp.

- U.S. Army. 2006. MIP weed management: *Rubus argutus*: in 2006 Status Reports for the Makua Implementation Plan and the Draft Oahu Implementation Plan, Directorate of Public Works, Environmental Division, Schofield Barracks. Pp. 2-1-21 to 2-1-23.
- U.S. Fish and Wildlife Service. 2005. West Maui mountains fencing and ungulate removal; Partners for Fish and Wildlife (122000G012).
- U.S. Fish and Wildlife Service. 2006. Puu Kukui watershed preserve pig fence; Malama Kahalawai Inc, Private Stewardship Grant (122005G023).
- Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejmanek, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. *New Zealand Journal of Ecology* 21: 1-16.
- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the flowering plants of Hawaii. University of Hawaii Press and Bishop Museum Press, Honolulu, Bishop Museum Special Publications 97. 1,919 pp.
- Wagner, W.L., M.M. Bruegmann, J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Museum Occasional Papers: 60 1-58.
- Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawaii, Version 3.1. December 12, 2003.
<http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm>.
- Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. National Tropical Botanical Garden. 25 pp.
- Wood, K.R. 2005. Summary report of research, *Acaena exigua* botanical survey, Puu Kukui summit, west Maui, Hawaii (1585—1765 m [5200—5788 ft] elevation). National Tropical Botanical Garden. P. 5.
- Personal Communications
- Bruegmann, M. and J. Burgett. Service, Memo regarding Puu Kukui site visit, October 9, 1996.
- Oppenheimer, H. Maui Pineapple Company, Response to request for candidate plant species information, November 30, 1999.
- Oppenheimer, H. Maui Land and Pineapple Company, Electronic mail message regarding review of candidate plant species status, July 7, 2005.
- Oppenheimer, H. Plant Extinction Prevention Program, Telephone interview regarding plant candidate species information updates, September 15, 2006.

Wood, K. National Tropical Botanical Garden, Telephone interview regarding status of plants on the summit of Eke, on west Maui, October 2, 1996.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: 
Regional Director, Fish and Wildlife Service

6/1/07
Date

Concur: 
Acting Director, U.S. Fish and Wildlife Service

November 27, 2007
Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review:
Conducted by: Cheryl Phillipson, Pacific Islands FWO
Biologist, Prelisting and Listing Program

Date: March 30, 2007

Comments:
PIFWO Review

Reviewed by: Christa Russell
Prelisting and Listing Program Coordinator

Date: April 4, 2007

Gina Shultz
Assistant Field Supervisor,
Endangered Species

Date: April 4, 2007

Patrick Leonard

Date: April 4, 2007

Field Supervisor